

CLAIMS

I claim:

1. A temperature control circuit for a fluid cooled engine having an engine block and a
5 cylinder head comprising:
 - a) a radiator having an input and an output;
 - b) an electrically driven water pump having an input and an output, the input of the electrically driven water pump being connected to a radiator output and the electrically driven water pump output being connected to a cylinder head;
 - 10 c) one or more sensors for sensing operational parameters of the engine;
 - d) a controller operatively connected to the electrically driven water pump and the one or more sensors for controlling the output of the electrically driven water pump; and
 - 15 e) a mechanical water pump operatively connected to the radiator and the engine, whereby the electrically driven water pump provides auxiliary cooling to the engine.
2. The circuit of claim 1 wherein the sensors include temperature sensor and an engine speed sensor.
3. The circuit of claim 1, further comprising an auxiliary fan and a fan relay, wherein
20 the controller is operatively connected to the fan relay and fan.
4. The circuit of claim 1 wherein the electrically driven water pump is a variable speed pump.
5. The circuit of claim 2, further comprising an adjustment control for adjusting a desired engine transition speed Sh of the temperature control circuit.
- 25 6. The circuit of claim 2, further comprising an adjustment control for adjusting a desired engine temperature Ts of the temperature control circuit.
7. An active water pump for a fluid-cooled engine fluid cooled engine having an engine block a cylinder head and a mechanical water pump cooling system comprising:
 - a) an electrically driven water pump having an input and an output, the input of the
30 electrically driven water pump being connected to a radiator output and the electrically driven water pump output being connected to a cylinder head; and

- b) one or more sensors for sensing operational parameters of the engine, whereby the controller controls the output of the electrically driven water pump in response to signals from the one or more sensors.
8. The circuit of claim 7 wherein the sensors include temperature sensor and an engine speed sensor.
9. The circuit of claim 8, further comprising an auxiliary fan and a fan relay, wherein the controller is operatively connected to the fan relay and fan.
10. The circuit of claim 8, further comprising an adjustment control for adjusting a desired engine transition speed S_h of the temperature control circuit.
11. The circuit of claim 8, further comprising an adjustment control for adjusting a desired engine temperature T_s of the temperature control circuit.
12. A method of controlling an operating temperature of an engine, the engine having a cooling system including a radiator assembly including a radiator and a fan driven by an electric fan motor; a coolant circulation circuit interconnecting the engine and the radiator for circulating coolant; a mechanical coolant pump disposed in the circulation pathway to pump coolant through the coolant circulation circuit; an electrically powered coolant pump disposed in the coolant circulation pathway to pump coolant through the coolant circulation circuit; an engine on/off sensor to detect the on/off state of the engine; an engine temperature sensor to detect a temperature of the engine coolant; an engine speed sensor to determine a speed of the engine and a controller operatively connecting the electrically driven coolant pump, the engine on/off sensor, the engine temperature sensor and the engine speed sensor, the method comprising the steps of:
- determining on/off state of the engine;
 - determining the temperature of the engine coolant and comparing the temperature with a target engine coolant temperature;
 - determining the speed of the engine and comparing the engine speed with a pre-selected engine speed transition point;
 - based upon the engine on/off state, the difference between the target engine temperature and the engine coolant temperature and difference between the

engine speed transition point and the engine speed, controlling the electrically driven coolant pump to improve the thermal performance of the engine.

13. The method of claim 12, wherein the electrically driven coolant pump is a variable speed pump, the method further comprising the step of controlling the speed of the electrically driven coolant pump to improve the thermal performance of the engine.
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